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Hand Gesture Recognition and Voice Conversionfor Speech Impaired

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Abstract
It is a great privilege to be able to talk and express our feelings out and as well as hearing it from others, as a normal human being. But there are few people who are not able to express their feelings out and it is very difficult for them as well normal people to communicate with each other in establishing a healthier society. So in order to overcome these situations and to support Deaf and Dumb people with two way full duplex communication our proposed system will be highly helpful. The proposed system will build a bridge of communication for Deaf and Dumb people to interlink with normal people. The system focuses on use of American Sign Language with which the hand signals are performed and use of flex sensors through which inputs are taken. The processed signal will be converted into text message and into a voicemessage.

Keywords - Bridge of communication, American Sign Language, Hand signals, Flex sensors, Text message ,Voice message

I. INTRODUCTION

Studies have found that deaf people are around twice as likely to suffer from psychological problems such as depression and anxiety. The suggestion from most researchers is that these issues are a result of the isolation associated with deafness. Obviously, it is more difficult to communicate with others when you're hearing impaired.

The hearing disorder may be broadly classified into three types.

Sensorineural hearing disorder: This disorder causes a prominent form of hearing impairment. It is caused when thereceptor nerves and hair cells are damaged mainly because ofage, noise. Sensorineural hearing disorder affects the pathways from receptor to brain. Majority of the times, this disorder can't be rectified medically or surgically, but can beassisted by the use of hearing aids.

Conductive hearing disorder: This kind of hearing loss is caused as a result of blockages within the outer or bodily cavity due to fluids, tumors, earwax. This blockage halts the sound waves from attending the receptor. This disorder can often be healed surgically or cured with medication.

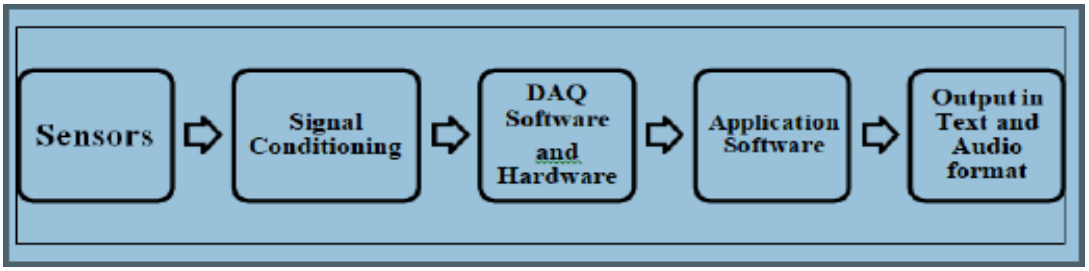
Auditory Neuropathy Spectrum Disorder (ANSD): This disorder is caused when the sound waves vibr

ating the cochlea are not organized or the hearing nerve doesn't process sound even if receptor encounters sound normally. There are possibly many reasons for this disorder like directly inherited through genes from the ancestors or due totrauma. ANSD can be induced in several cases such as lack of oxygen at birth, blood transfusion is required, premature birth, at the time of birth, ototoxic drug exposure, immune disorders, mumps caused by infection and many more.

As D&D people use sign language to communicate it will bethought to them through special schools and among them American Sign Language (ASL) is the most preferred one and is employed by USA, India, parts of Mexico and Canada. ASL may be a language with its own unique rules of grammar and syntax. ASL also grows and changes with time like the rest of the languages and ASL is welcomed by many high schools, colleges, and universities in fulfilment of contemporary and foreign language honor requirements.

II. PROPOSED METHEDOLOGY

The below block diagram depicts the flow of control on how the system works and the co-ordination of different subsystems. The subsystems should work in a coordinated manner and in a synchronized manner in order to achievethe desired outcome.



. Fig.1. Proposed block diagram

A. Sensors

Commercially available five flex sensors are attached to the gloves which act as smart gloves. Flex sensors change their resistance values when it is bent. As the resistance of the flex sensor varies, the voltage across them also changes. The resistance increases with increase in the bending of the flex sensor. Hence, maximum voltage output is obtained when the flex sensors are open. The voltage values from the flex sensor are given as input to the LabVIEW software.

B. Signal Conditioning

Voltage divider circuit is used to acquire the signals from the flex sensors. Two threshold values based on 45° and 90° bending of the flex sensors is considered. The voltage values obtained based on the hand gesture is then compared with these thresholds.

C. *DAQ software and Hardware components*

The data acquisition card acquires signals from the flexsensors and feeds it into the LabVIEW software. The USB-6008 provides basic functionality for applications such as simple data logging, portable measurements, and academic lab experiments.

D. *Application software*

The software used for the implementation of this project is LabVIEW. LabVIEW stands for Laboratory Virtual Instrumentation Engineering Workbench. LabVIEW is a type of visual programming language. Very easy to programusing built in function palette.

E. *Output*

The letter shown by the smart gloves is displayed in both text and audio format. The letters shown are also concatenated to form words.

III. REQUIREMENTS

A. *Software RequirementsLabVIEW*

The software used for the implementation of this project is

LabVIEW. LabVIEW stands for Laboratory Virtual Instrumentation Engineering Workbench. LabVIEW is a type of visual programming language. This programming language is widely used for various applications by engineers. These applications include design and development of instruments and devices, measurement of the devices and testing, monitoring and controlling the devices. The signs made by moving the hands in order to convey a message to hearing impaired are converted to letters and words by acquiring signals from gloves worn by the user. The gloves have flex sensors to convert the hand movements and orientations into various voltage levels. LabVIEW converts the different voltage levels into a binary code. Based on the binary code, the letters and words are translated. The word is then converted into a speech signal and an audio output. API and drew the path from source to destination via a polyline. The current prototype system navigates the user to a limited number of locations only because it sends the latitude and longitude values of the destination location to the Directions API to find out thepath to destination.

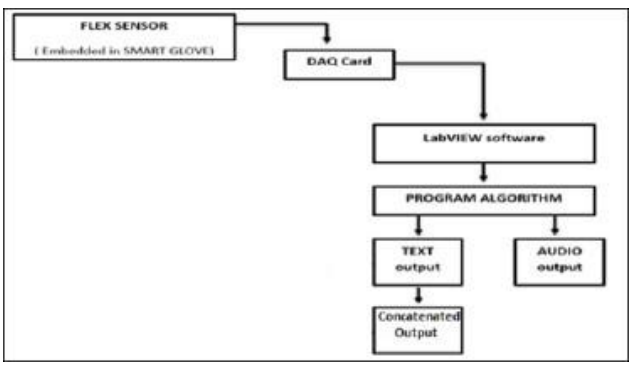


Fig.2. Block diagram of Software Implementation

The output of the voltage divider configuration is describedby the equation:

$$V_O = V_{CC}\frac{R}{R + R_{Flex}}$$

In the shown configuration, the output voltage decreaseswith increasing bend radius.

For example, with 5V supply and 47K pull-down resistor, when the sensor is flat (0°), the resistance is relatively low (around 25kΩ). This results in the following output voltage:

$$V_O = 5V\frac{47k\Omega}{47k\Omega + 25K\Omega}$$
$$= 3.26V$$

When flexed all the way (90°), the resistance rises to 100KΩ. This results in the following output voltage:

$$V_O = 5V\frac{47k\Omega}{47k\Omega + 100K\Omega}$$
$$= 1.59V$$

B. Hardware Requirements

The components used for this project include:

A. NI USB DAQ Card 6008:

The USB-6008 is a low-cost, multifunction DAQ device. It offers analog I/O, digital I/O, and a 32-bit counter. The USB-6008 provides basic functionality for applications such as simple data logging, portable measurements, and academic lab experiments.

The device features a lightweight mechanical enclosure and is bus powered for easy portability. You can easily connect sensors and signals to the USB-6008 with screw-terminal connectivity. The included NI-DAQmx driver and configuration utility simplify configuration and measurements.

B. Flex Sensors

A flex sensor is a kind of sensor which is used to measure the amount of defection otherwise bending. The designing of this sensor can be done by using materials like plastic and carbon. The carbon surface is arranged on a plastic strip as this strip is turned aside then the sensor's resistance will be changed. Thus, it is also named a bend sensor. As its varying resistance can be directly proportional to the quantity of turn thus it can also be employed like a goniometer.

Breadboard, connecting wires, USB Cable, 22k ohm resistors and 9V battery Voltage divider circuit for flexible sensors is built on the bread board, then connected to Analog input channels available on USB-6008 DAQ card and then to PC via USB cable.

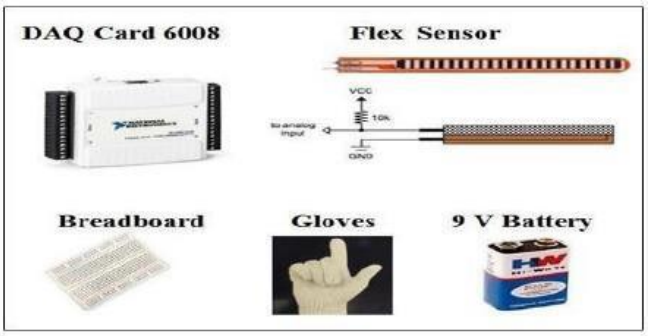


Fig.3. Hardware components

IV. METHODOLOGY

The proposed project using Smart gloves and LabVIEW software for translation based on the American Sign Language system. Uses flex sensor to obtain the bio-signals from finger based on hand gesture using LabVIEW software

Fig.5. Shows the voltage divider circuit for connecting Flexible resistive sensors Let Resistance of Flex sensor be RF and we use another resistance R = 'X' kΩ. The input voltage is Vin and voltage obtained is Vout given by: Vout coming from each flexible Resistive Sensors is connected to Analog input Channel of NI USB -6008 DAQ card.

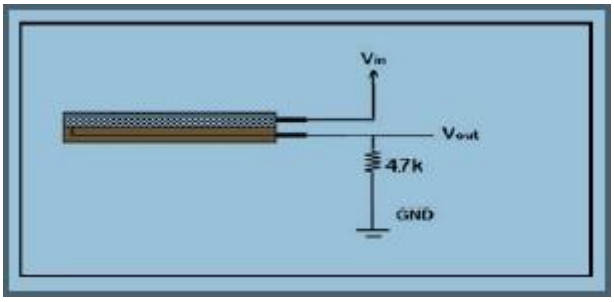


Fig.5. voltage divider circuit

All 26 letters were then gestured using the smart gloves and the LabVIEW software could convert these signals to their corresponding values. The algorithm is based on the flow chart depicted in Figure 3.4.3 The input from each of the five flex sensor is obtained and analyzed if the corresponding finger is open, half closed or fully closed. Depending on this, O, C or M is given as obtained. Such strings are concatenated from all five fingers and are concatenated. The concatenated string is then compared with the string assigned to each letter and the corresponding letter is shown. These letters are then concatenated to form words and sentences. The output is given in both text and audio format

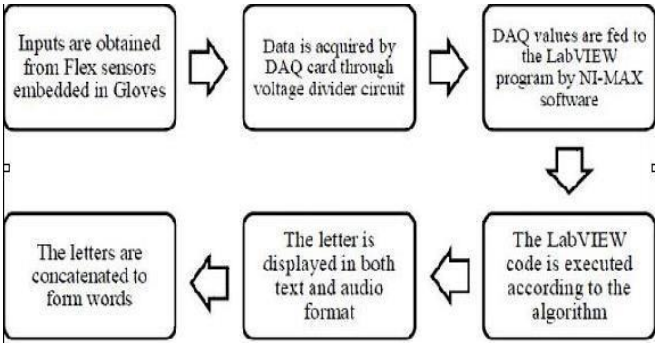


Fig.4. Overall block diagram of hardware and software

The input from each of the five flex sensor is obtained and analyzed if the corresponding finger is open, half closed or fully closed. Depending on this, O, C or M is assigned as obtained. Such strings are concatenated from all five fingers and are concatenated. The concatenated string is then compared with the string assigned to each letter and the corresponding letter is shown. These letters are then concatenated to form words. The flowchart of the software implementation of processing the values obtained from the flex sensors is depicted.

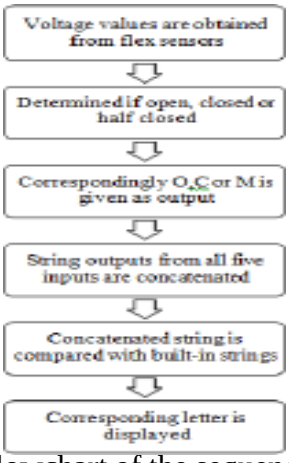


Fig.6. Flowchart of the sequence

V. CONCLUSION

The project presented brings a new solution for deaf and dumb people and thereby increasing self-confidence. Conventionally the focus of similar projects have been on image sensing, image processing, database and IoT whereas the proposed project is keen to be focusing on LabVIEW . Usually there is a restriction in the maximum number of letters that can be concatenated. But, here in this algorithm since we have used “for loop”, there is no limit to the number of words that can be concatenated. Hence word of any length can be formed. If space constant is introduced into the code, sentences can also be formed

The system has more accuracy and less time delay compared to the already existing works. The overall project is built to help deaf and dumb people for giving them a voice in public and it would really become a boon for D&D people.

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